# A Smart Transportation Management System for Managing Travel Events

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## ABSTRACT
Culinary tourism is on the rise as a growing number of people want to join trips full of people, food and drinks. This paper presents the main idea of an intelligent transport system developed for ale trail lovers who wish to join culinary tours. The system is based on a web application that handles organising, scheduling and viewing a currently live trail and a consumer-side cross-platform mobile application that provides updates on bus schedules, bus location and nearest bus stops etc. The system is used to automate the process of organising culinary ale trails. By using this system, massive culinary ale trail events can be arranged quickly and efficiently.

## CCS Concepts
**• Human-centered computing → Human-computer interaction (HCI) → Interactive systems and tools • Software and its engineering → Software creation and its management → Software development techniques → Software prototyping.**

## Keywords
Ale trail; Intelligent transportation; Management system; Web application; Scheduling.

## 1. INTRODUCTION
Technological advancements in the 21st century have increased tourism opportunities for people in general. These advancements have affected people choices as they now prefer customised designs, manufacturing, shopping experience, that fulfil their specific need [1]. Similarly, tourists now expect tailored-made tourism plans and packages catered to their particular requirements.

### 1.1 Culinary Tourism
In recent years the culinary tourism has emerged as one of the fastest-growing trends within the overall tourism industry. According to the World Tourism Organisation, culinary tourism is defined as *"the pursuit of unique and memorable eating and drinking experiences"* [2]. Culinary tourism offers an authentic taste of the place by combining travel with edible and drinking experiences for both tourists and as well as for local people.

Since 2001, culinary tourism has gained popularity, and its economic impacts are visible among the tourism industry. Estimates from the World Food Travel Association show that between 15% and 35% of the overall tourism industry spendings belong to food and beverages [3]. The promotion of culinary tourism experiences can result in more opportunities for local shops, restaurants and pubs etc. Additionally, the consumption of local food and beverages bring travellers closer to the local culture [4].

Beer tourism is another extension of culinary tourism. It is becoming famous in many European countries, Australia and the United States of America [5]. The popularity of new-localism is also aiding the popularity of visiting local beer shops and buying local beer. As a result, local businesses are not only attracting more visitors but are also increasing job opportunities for local people, especially in rural settings [6]. Although culinary and beer tourism are continuously growing; it remains an under-researched area, asking for exploration of different research avenues to promote such kind of tourism activities [7].

### 1.2 Intelligent Transportation System
Developments within information technology have promoted significant changes in the transportation infrastructure. Many Intelligent Transportation Systems (ITS) have been proposed to assist travelling in recent years. An intelligent transportation system (ITS) is *"an advanced application which aims to provide*


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*innovative services relating to different modes of transport and traffic management and enable users to be better informed and make safer, more coordinated and 'smarter' use of transport networks"*. ITSs can be useful in improving transport efficiency in many situations, i.e., traffic management, mobility, road transport etc. [8]. ITSs can use communication technologies for assisting transport managers and vehicle drivers in information sharing, informed decision making and safer driving experience [9]. However, there is still a lack of research related to intelligent transportation systems for improving automation and safety of mobility from one place to another, especially in the context of culinary tourism [10].

## 1.3 Motivation

Regardless of the advantages and economic impacts of the culinary and beer tourism, there are some relevant concerns as well. Some people can get drunk during their visits to pubs, and it becomes dangerous for them to drive in such situations. Several companies are promoting culinary tours around the world. However, none of them has tried to manage culinary ale trails using the ITS.

As a potential solution to this problem, this study focuses on a solution that can promote culinary tourism using an ITS and still not compromise on visitor safety. By using the ITS developed for the study, visitors do not have to drive themselves. Bus drivers provide transport between destinations along the trail. The primary aim of the paper is achieved by focusing on the following objectives.

Objective 1: To explore the importance of culinary tourism in the overall tourism industry.

Objective 2: To identify the need for the intelligent transportation system for promoting culinary tourism.

Objective 3: To develop a smart transportation system based on the needs of travel companies.

This paper has six sections. Section 2 describes the background of this study. Section 3 summarises methodology. Section 4 presents the design and prototype of the ITS. Section 5 presents a case study and summarise the potential impacts of the study. Section 6 offers the conclusion and future work.

# 2. STUDY BACKGROUND

This section covers the background of this study to show which factors contributed to the development of the proposed ITS. According to the World Food Travel Association, the culinary tourism industry cluster is focused on three main areas, which include "food and beverage businesses, travel and hospitality businesses and other related businesses and organisations". This cluster is further divided into 20 interrelated sectors, as shown in [3].

Engaging stakeholders in these clusters often prove difficult. However, customised culinary destination and marketing strategies can be useful for stakeholders' engagements in such businesses. Considering this, The culinary tourism companies usually develop their business models based on three main areas from the cluster of the food tourism industry. Their focused sectors include

- Restaurants, cafes, bars etc. from the food and beverage business.
- Tour operations and transportation from the travel & hospitality business.
- Technology platforms from related business and organisations.

Previously, culinary ale trails tourism companies conducted such tours and events by using traditional means of bus transport to pick up customers from designated stops, take them to different pubs and drop them back to their stops. However, due to lack of technology integration and automated event management applications in their business, the culinary ale trail events were not easy to manage in systematic ways.

Additionally, customers were not able to monitor the live status of buses or see information about the destinations on their electronic devices; instead, they have to rely on brochures and information leaflets. Therefore, both tour companies and their customers faced some inconsistencies in such trips.

As a potential solution, culinary ale trail companies wanted some smart transportation systems that can help them to manage their culinary ale trails systematically with the help of latest technologies. To the best of our knowledge, there are no studies focused on integrating smart transportation systems into culinary ale trails. Therefore, this study was initiated to come up with a solution that can achieve the objectives set out in the introduction section.

# 3. METHODOLOGY

This section outlines the user-centred development process used for this study. Due to the nature of this research project, agile software methodology is followed throughout the developmental process. In agile *" the requirements and solutions evolve through the collaborative effort of self-organising and cross-functional teams and their customers or end-users"* [11]. Agile is based on the idea of adaptive planning, evolutionary development, earlier delivery and continuous improvements.

## 3.1 Requirements Workshops

The process started with multiple workshop sessions with experts from the culinary ale trail industry. These workshop sessions helped to elicit system requirements and to define the scope of the system. The prototyping approach was applied for the system development with the industrial experts remained involved throughout the development process.

## 3.2 User Involvement Throughout Development

Meetings were held at multiple intervals where stakeholders met and discussed the progress of the project. During each session, the research team provided demonstrations of the product to exhibit which requirements have been achieved and which requirements are targeted to accomplish in the succeeding meetings.

## 3.3 System Testing

Comprehensive testing was carried out for both web and mobile application platforms. Different tests helped to assess the product quality as well as to make sure it would meet the requirements on culinary ale trail companies. During the initial stage of testing, both applications included functional testing, load testing, performance testing, integration testing, negative testing, API testing and browser testing.

The second stage of testing was conducted for scheduling trails. This testing allowed the users to create trails, schedule trails and then making the trails live to test their functionalities.

# 4. CONCEPT DESIGN AND PROTOTYPE

The ITS application is developed by following the concept of co-design by involving industry experts throughout the developmental process, as described in the previous section [12].

## 4.1 System Design

Figure 1 illustrates the design and implementation of web and mobile applications. The Azure API controls all management of data processing. The web application uses the Google Maps API to run service requests such as directions display, route calculations, etc. all data required from the database like routes, scheduled routes and active routes are pulled using the Azure-hosted web API.

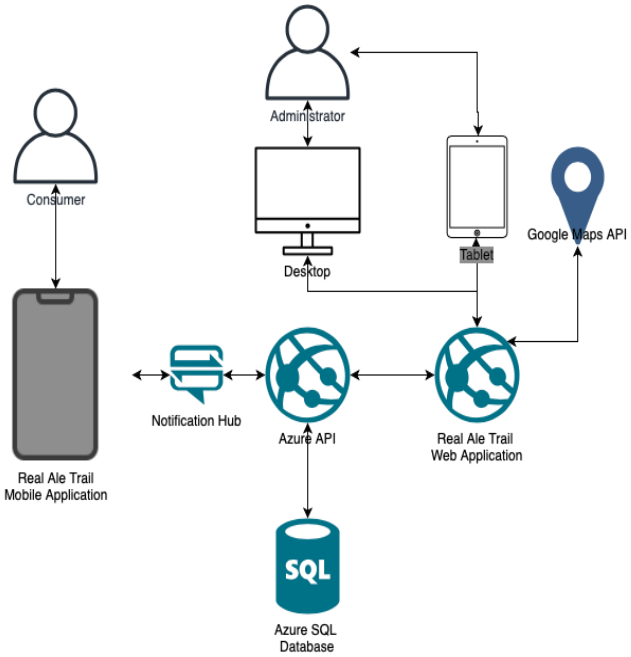


**Figure 1. Concept Design of the Application**

## 4.2 Web Application Process

Figure 2 presents the flow chart for the web application. The flow chart summarises the step-by-step process used for the solution. The web application has been designed to be responsive from desktop down to a landscape tablet. The process of running a live ale trail is split across three distinct stages (create, schedule, and live) to allow for the creation of template trails. Template trails mean that the same trail can be scheduled multiple times, on different dates, without the need to duplicate data entry.

Create a Trail: Creation of the route is split into two separate steps; the first is laying out the pubs along the route. The second is adjusting the route to be easily accessible by the bus. Currently, pub information cannot be altered once created, without manual database entry editing; route creation could be improved with the ability to edit the pub's information. This would be useful for situations where phone numbers/pub names change or if any additional information needs to be added.

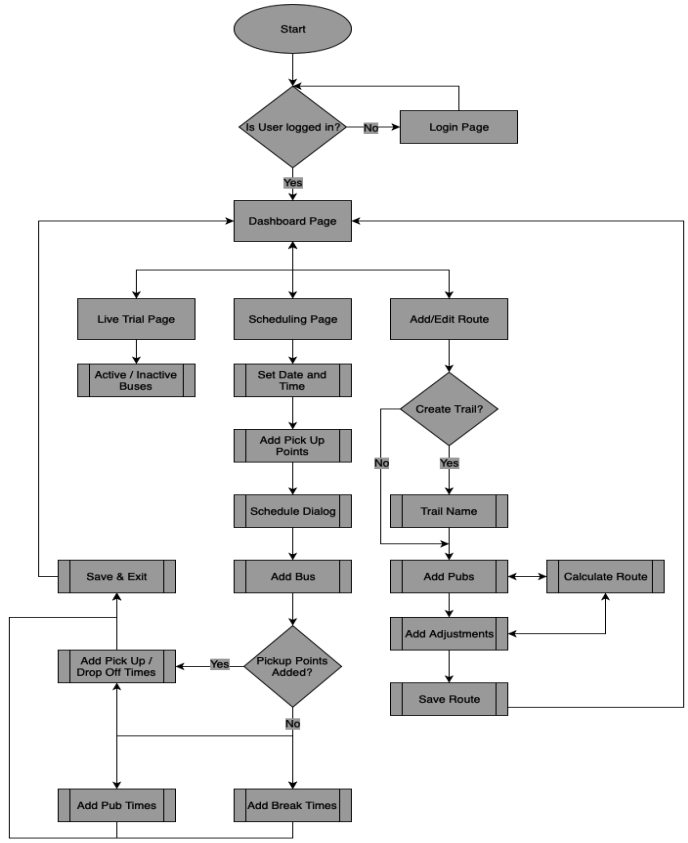


**Figure 2. Flow Chart of Web Application**

Schedule: Scheduling a route is also split into two stages. The first is adding the pickup points; the second is assigning and scheduling the buses. When scheduling a bus to go from a pub to a pickup point and vice versa, the user is prompted to create a sub route between the two locations. This functionality gives the user the ability to send a bus from any location along the route to any pickup point if needed, rather than always going from the same pub. Additionally, an administrator will be shown the estimated travel time between destinations, via Google Maps API, in order to aid scheduling. These times can be adjusted to better reflect the travel time between any two locations. Adjustments to travel and pickup times auto update subsequently scheduled timings for ease of use. If a scheduled route is edited, a check is made to ensure that no scheduled route is currently running or if this route has been scheduled in the past. If a scheduled route has already occurred or if one is currently running then a duplicate is made of the historical data, the new copy is given an incremented version number, and the new version is edited. This preserves the integrity of historical data and allows the ITS administrators to make the required edits for future trails. This functionality is useful for situations where a new destination is added to a trail, or different buses are used.

Live view: Live view allows administrator users to view the current locations of buses along the trail. The user can click on each pub to display information entered previously about it. For example, if the administrator requires the phone number of a pub. Figure 3 presents the flow chart for the mobile application. The steps followed to achieve the solutions are presented here.

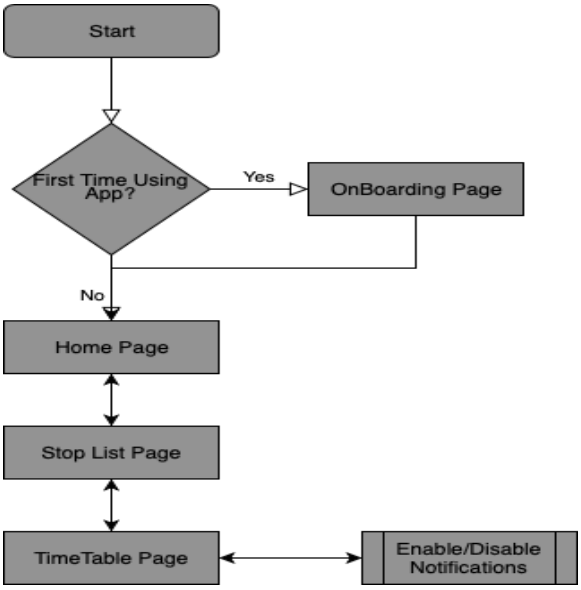


**Figure 3. Flow Chart of Mobile Application**

The mobile app is designed to be simple for all people to use with only four screens in total.

Onboarding: A set of images that visually describe the functionality of the app, only displayed the first time a user uses the app.

Choose a trail: Choose the preferred trail from a list of available trails.

Choose a pub or pickup point: Ordered by distance closest to the user. The application will ask the user to allow the use of location data and notifications. If the user declines, they can allow through the settings app.

View bus times and subscribe to buses: Ordered by soonest first.

## 4.3 Application Prototype

ASP.NET,created by Microsoft, is used for the server-side development of the web application and Javascript, Cascading Style Sheets (CSS) and HyperText Markup Language (HTML) for client-side code. ASP.NET is an open-source C# framework for developing modern web applications and services using .NET.

Xamarin is used to develop the cross-platform mobile application, for both iOS and Android versions. The mobile application was written in C# and then compiled to the target platforms using native compiling service.

The Azure SQL Database is chosen for the system, as it could be hosted on the cloud, supports relational database model and is extensible for future developments. ASP.NET Core was used to develop the ITS. The controllers added to the API include route, scheduling, login, live, overview, location and buses. The front page for the web application is presented in figure 4.

The administrator has to login to access dashboard page. The administrator can use this dashboard portal to create, manage and view new trails. While creating a trail, the administrator can add restaurants/pubs, add a scheduled trail, adjust existing scheduled trails. Adjustment options include adding or removing buses, pick up / drop off locations, and generate bus timings etc.

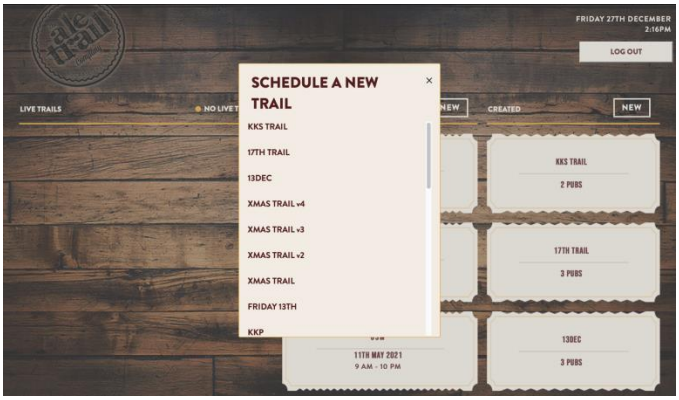


**Figure 4. Web Application Screenshot**

There are many advantages of using the ITS web application, including: Vehicle and road tracking, Traffic flow and traffic management, Driver behaviour and safety, pick up/drop off points, vehicle navigation, scenarios simulation and vehicle control.

The mobile application functionalities are presented in figure 5. The end-users will be able to use this application on their smartphones (both iOS and Android). The home page of the mobile application contains a list of any live trails; it displays the dates and times for when the trail begins and ends. It further lists any pubs and pick up/drop off points associated with the trail that is near the user's current location. This way, users can start or join the trail by finding a stop near them. Each card displays the distance the user is from that stop in miles.

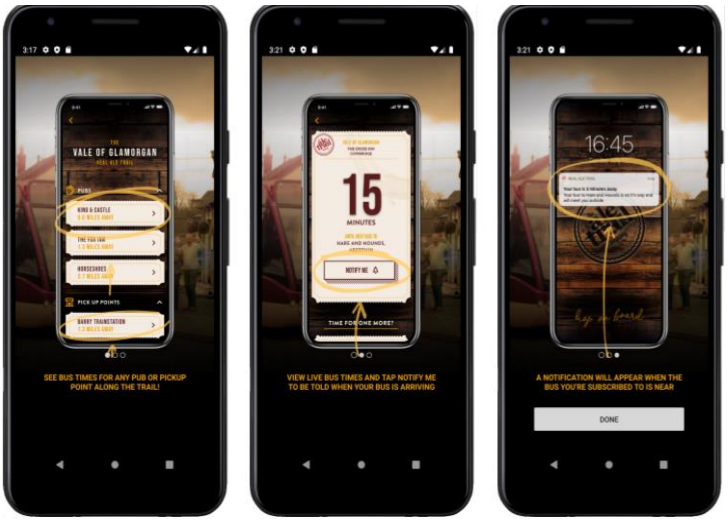


**Figure 5. Mobile Application Screenshot**

# 5. THE REAL ALE TRAIL CASE STUDY

Using the ITS application while participating in an ale trail would be very simple. A company called The Real Ale Trail has already started using this recently developed ITS for managing their culinary ale trail events. For joining The Real Ale Trail events, the attendees can easily book their tickets through the website. Tickets would be valid for the whole day. After booking the ticket, the user can join the ale trail from their nearest bus stop. A bus chauffeurs you all day through spectacular countryside to rural pubs. Every half an hour or so, a bus will appear at each pub on the trail to ferry you to the next pub. You can visit as many or as few pubs as you

want and stay at each one for as long as you want. The Real Ale Trail focuses on quirky, off the beaten track and hidden pubs, that attendees may never have heard of or visited, where real ale and great hospitality are priorities. The real pleasure of the festival comes from exploring pubs and ales you've never tried before, without worrying about driving.

The use of The Real Ale Trail application is anticipated to have a positive impact on users wanting to attend culinary ale trails. Even users who do not have anyone to accompany them on such trips can join others through this service. They will be able to meet new people and make new friends. It will also be useful for the other event management companies to automate their travel events with the help of this application.

The advantage of this smart travel system is that even if people get drunk, they do not have to drive. The bus driver can drop them at their stops. It will help local shops in improving their business and more job opportunities. Additionally, it will increase socialisation opportunities for people travelling alone.

## 5.1 Study Contributions

This study can support in marketing strategy for the culinary tourism companies. It will promote the use of the latest technologies for efficient management of culinary tourism and ale trips. The smart transport system helps people to travel safely even after being drunk.

# 6. CONCLUSION AND FUTURE WORK

Considering the popularity of culinary and beer tourism, there is a need to come up with technological solutions for the organisation and management of tourism activities. This paper presented the idea of an ITS capable of automating the culinary tourism trips. All the process starting from the requirements through system design, development, and testing have been explained in detail. This study has highlighted the importance of culinary tourism and its significance in the overall tourism industry. Additionally, this study highlighted the use of ITS for culinary tourism and explored the requirements of the tourism industry for such ITS. The application presented in this study has the potential to automate culinary ale trail events that can be useful for both customers and tourism companies.

The major limitation associated with this study is the lack of user testing from the target audience. Hence, future testing has been scheduled in collaboration with a culinary tourism company.

# 7. ACKNOWLEDGEMENTS

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